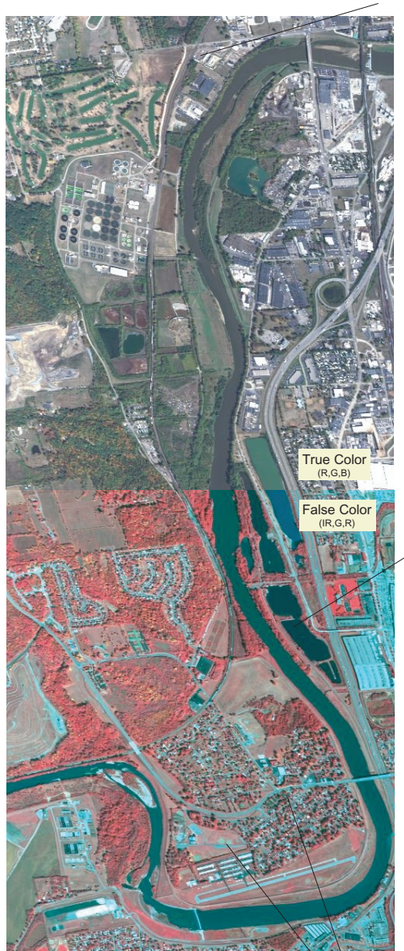
Measuring for Chlorophyll and Suspended Sediment Concentration in the Great Miami River

Airborne Imagery of Great Miami River (pixel size: 5 m) - River Mile 69.5 to 75.5



FLYOVER

First 12 sites sampled
80 km of river sampled

Second 3 sites sampled
10 km of river sampled
pre/post rain event

Confluence of Stillwater and GMR

Water Layer Showing Spectral Differences

Imagery by AIG|HyVista

GOAL

Develop an indicator of nutrient and sediment loads in deep rivers that provides information for an entire river.

METHODS

BIOLOGICAL PARAMETERS

- Total Suspended Solids
- Dissolved Oxygen
- Turbidity
- Chlorophyll a, b and c
- pH
- Temperature
- Secchi Depth
- Algae ID
- Water Chemistry - TKN/TP/NO2/3, NH4

HYPERSPECTRAL MEASUREMENTS

The measurement of reflected energy in narrow wavelength ranges of the electromagnetic radiation spectrum

Above water light reflectance and the underwater light field are measured using:

1) Hand-held field spectroradiometer (FieldSpec Fr) scans: 350-2500 nm
2) LiCor underwater sensor: (PAR)
3) Imaging sensors aboard an Aircraft
   CASI (19 bands, 5 nm): 400-1000 nm
   HyMAP (126 bands, 15 nm): 400-2500 nm

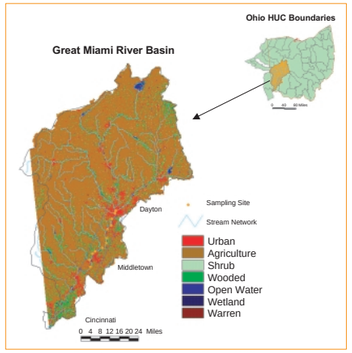
TEMPORAL STUDY

4 sites to characterize summer low flow

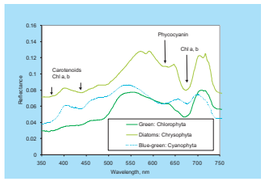
30 km of river sampled

Mixing Zone: With Discharge from a WWTP

Taking Hyperspectral Measurements Above Water

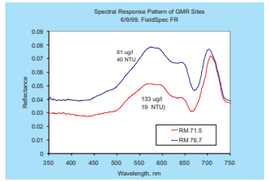


Spectral Response of Water Willows



Reflectance response spectra of pure population of algae. Absorption troughs (low reflectance) in each spectrum are due to specific pigments. The type of dominant pigment determines the location (wavelength) of the troughs. The magnitude of the troughs is associated with the concentration level.

Reflectance was measured from a bucket containing diluted cultures.



Typical reflectance spectra in the Great Miami River. High turbidity values correspond with high reflectance values in the green band (around 580 nm) while high chlorophyll values correspond with deeper troughs in the red band (around 675 nm).

Reflectance spectra shows similarity with the spectra of diatoms due to their dominance in the River.

STEPS FOR DEVELOPING HYPERSPECTRAL METHODS TO DIFFERENTIATE AND QUANTIFY ALGAE, TOTAL SUSPENDED SOLIDS AND MACORPHYTES

1. Identify useful hyperspectral bands
2. Develop mathematical models to describe interactions and relationships between hyperspectral data and in-stream parameters
3. Develop spatial distribution maps using remotely sensed imagery

Airborne Imagery of Great Miami River (pixel size: ~3 m) - River Mile 45 to 90